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DAYLIGHTING IN HISTORIC BATHHOUSES: THE CASE OF OTTOMAN *HAMAMS*

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INTRODUCTION

Light and sun have always been important features in past civilizations, since their significant status in science, philosophy and religion, as well as the ability to create special impressions and sophisticated visual environments have contributed to the efficient management of light in important buildings of each era.

The current paper attempts to "shed light" on the visual conditions prevailing in buildings of the past with specific use and typology, such as the Ottoman *hamams*, aiming mainly at verifying the interrelationship between daylighting and spiritual or religious purposes derived from their primary function. In order to achieve such a goal, it is necessary to refer to the background of bathing philosophy and the symbolisms found in Ottoman *hamams*, before describing the methodological approach and the findings of the research.

FOUNDATION OF OTTOMAN *HAMAM* ALONG WITH THE CHANGING BATHING CULTURE

Bathing philosophy has a long history across the centuries. In each era, the bathing establishments acquired their features and characteristics following the value attached to them in each culture and fulfilling the requirements evolving from each use taking place in their context.

The story of bathing starts with the purification of soul and body as a means of preventing illness. The input of different cultures and societal practices has transformed the role and meaning of the former basic outdoor activity into an indoor bathing ritual. Regarding the historical context, Greek gymnasium has provided the social and architectural environment for one of the earliest forms of communal bathing in ancient society by incorporating full washing and bathing facilities (Yegul, 1992). The planning of the Greek bath is simple and functional; it is characterised

by rectangular or irregularly shaped units clustered around one or more circular chambers. Although there is a sense of unity and organization to the plan, an order of use between the various units is not evident even in late elaborate structures (Yegul, 1992). Nevertheless, it provided the primary inspiration for Roman bathing, which incorporated physical exercise as a fundamental part of its routine.

The universal acceptance of bathing as a central event in daily life belongs to the Roman world. Apart from their normal hygienic functions, they provided facilities for sports and recreation (Caskey, 1999), creating thus a proper environment for social intercourse. There was even a cultural and intellectual aspect given to the baths, since the grand establishments, the *thermae*, incorporated libraries and lecture halls (Yegul, 1992). The organization of planning in Roman baths was based on the principle of temperature gradation (Vitruvious and Morgan, 1960). Since bathing was considered as a central event in daily life, the buildings which housed such functions received much attention in order to fulfil all requirements and preferences. Written sources reveal that the high vaulted ceilings and large semicircular or arched windows of the "warm" and "hot" chambers were admired by the bathers (Vitruvious and Morgan, 1960). In some Roman bathing establishments, the *heliocaminus*, a circular or semicircular projecting hall with large windows with a south or southwest orientation, was used for sunbathing, offering additional pleasure to bathing (Yegul, 2010). It is worth mentioning that at this era bath and bathing were not associated with any religious purpose. On the contrary, their luxurious interiors intended to offer a secular experience, rather than spiritual cultivation.

Baths remained one of the popular institutions of late antique and early Byzantine cities (Caskey, 1999), although bathing as a luxurious activity contradicted the Christian notion of spirituality, which was supposed to be achieved through the negation of the body and the senses. Although bathing was never rejected or banned on the grounds of religion, the construction of new bathing structures became confined after the seventh and eighth century (Yegul, 1992).

In parallel, the bathing culture in Middle East and Islam environments was experienced in *hamams*. *Hamam* in Arabic meant "spreader of warmth" and began to flourish especially after Prophet Muhammad recommended sweat bathing in 600 C.E. The *hamam* became paired with mosques to satisfy the needs for hygiene and purification, which are significant in Islamic regulations (Yegul, 2010). The bath was given a high position in the daily and weekly activities of the society, as emphasized by the Quran and Hadith. Cleanliness, under Islam, is a religious duty to be performed daily by the believer in his ablution for the five daily prayers. Allah established this in the Quran: "Indeed, God loves those who turn to him constantly and He loves those who keep themselves pure and clean" (Ali, 2001). The prophet Mohammed confirmed this in his saying: "Cleanliness is half the faith" (Ali, 2001).

Between the eleventh and fifteenth centuries, the Turkish conquerors of Asia Minor became acquainted with the small public baths in Byzantine cities, as well as with the Arabic-Islamic *hamams* throughout Syria and Egypt (Mahomed, 1843). As the Ottoman Empire adopted Islamic religious characteristics, it incorporated patterns of urban life existing in Islamic culture. Ottoman *hamams* were found and developed as the direct descendant of this long line of baths and bathing culture (Aaland, 1978).

ARCHITECTURAL CHARACTERISTICS WITH REGARD TO THE ILLUMINATION OF OTTOMAN *HAMAMS*

As expected, *hamams* have developed in an architectural style that combined the functionality and the structural elements of its predecessors (the Roman *thermae* and Byzantine baths) with the Turkish-Muslim tradition of bathing, ritual cleansing and respect for water (Aaland, 1978).

A typical *hamam* consists of spaces that are organised in a common layout and follow a plan related to temperature gradation, which corresponds to the ritual of a *hamam* visit. The spaces are named after their adopted function as cold, tepid and hot room. More specifically, the cold room is the welcoming and disrobing area. It is the only space of the *hamam* that would have windows at street level and/or at higher levels. It was equipped with lanterns, which would emphasize the central space orientation and a possible fountain that was located in the symmetry axis of the entrance portal.

The tepid room is the warmed space that links the disrobing area to the hot room and prepares the body for the increasing temperature and humidity that is supplied through the water vapor. Tepid spaces are cells or rooms where usually low natural light levels exist.

The hot room is the destination space of the ritual where the gathering and the activities take place. It is mostly a spacious room, usually enlarged with cells or sections around the central area. It is mostly dominated by a central marble slab that is surrounded by basins where the water is supplied from. The central slab, as its seating, is the center of the activities, where the massage, cleaning or the leisure activities take place. The centrally oriented composition of the hot room is enhanced by a central lantern and/or oculi around it. The hot room is mostly a moderately illuminated space with a mystical atmosphere created through the downward daylight from the domed superstructure. The character of the light mostly varies by the positioning, the geometry and the color of the capping glass of the oculi.

Apart from the main *hamam* quarters, the water depot and the furnace are also vital parts of the building, but they are not visited during the bathing ritual.They are serving spaces of the *hamam,* which are mostly dark.

In general, illumination in *hamams* is sustained mostly through natural light (Önge, 1978); artificial lighting is used as a subsidiary. Daylight is received through openings on the lateral and roofing structures of the spaces. More specifically, windows on the walls, as well as lighting lanterns (cupola) and oculus (oculi) on the roofing structures are the sources of daylight, while gas lamps and candles are utilized as artificial lighting subsidiaries.

The number and positioning of openings in *hamams* are directly related with the privacy and the character of the space. Hence, lateral window openings are less common; they mostly exist at upper levels and are accompanied with plaster or wooden preventive decorations. Lighting lanterns or cupolas and oculi are the profound daylight sources of *hamams*. Historical documents suggest that the lighting details on the dome were designed and constructed together with the *hamam* building itself since its early practices (e.g. 15th century İsmet Bey Hamam, İznik) (Önge, 1978). The lighting lanterns are upward projecting and are mostly timber structures covered by a conical or flat surface. They are octagon, hexagon or square shaped prisms, through the vertically windowed sides of which the light enters the space. Moreover, there are also examples of glass capping

with solid sides, e.g. Çemberlitaş Hamamı, İstanbul (Önge, 1978). Oculi are small openings on the domes capped with upward projecting glass coverings. They appear in various forms; circular, polygonal or star, as they also vary in their settlement pattern over the roofing structure. Besides, they are essential decorative elements. With the help of their differently colored cappings or plaster work that covers the openings, the imprints of light on the surfaces of the indoor spaces enable different atmospheres to be created, e.g. Yeşildirek Hamam, İzmir (Önge, 1978).

The studies conducted on the lighting of *hamams* mainly focus on the quality, quantity and the accessibility of the natural light within the indoor spaces. Given the fact that the illumination in *hamams* is based on daylight, it is expected that its levels and distribution are directly related with the architectural design (size, form, decoration) as well as the function of the space.

Although Ottoman *hamams* were one of the important stages where social life took place, they were not only functional buildings; they were symbolic implications of status and offered an expression of existential meanings (Buyukdigan, 2003). To serve this role, the *hamams* were actively promoted by the elaboration of their design, techniques and embellishments. Illumination and the use of daylight have been a medium for achieving this elaboration; in many cultures daylight has been associated with divine and spiritual powers and it often symbolized truth, purity and life. Similarly, besides covering the visual needs, lighting in *hamams* provided a sense of spirituality to the spaces, since it could be referred to as the light of Allah that purifies the soul.

METHODOLOGY: RECORDING ILLUMINATION LEVELS IN OTTOMAN *HAMAMS*

The study was based on understanding the behaviour and use of daylight in Ottoman *hamams*. For that purpose, the seven still existing *hamams* that were built along the Ottoman Empire rule over the city of Thesssaloniki were surveyed and one was studied specifically through illumination level recordings.

Bey Hamam was chosen as the subject of the study since it constitutes the first *hamam* practice of the Ottoman in the city. It was built in 1444 with the classical period *hamam* typology and construction technique of the empire and had been in use with the name Baths of Paradise until 1968 (Kanetaki, 2004a). It was restored after the earthquake of 1978, and since then it has been hosting cultural events and exhibitions. Meanwhile, the eastern annex of the building has become the principal shop of the Foundation of Archaeological Receipts of the Hellenic Republic Ministry of Culture (Kanetaki, 2004b).

Bey Hamam is a classical double bathed *hamam*, with two separate parts for men and women; the male quarters are the most spacious and luxurious, but both follow the succession of three parts, the cold, tepid and hot rooms (**Figure 1**). Currently, the woman's quarters are not fully accessible to the public.

The male quarters include a large octagonally shaped cold room, where lateral windows arranged in two levels on the external masonry provide daylight to the interior; four windows are located on the ground floor in each free side of the octagonal envelope, while eight shorter windows

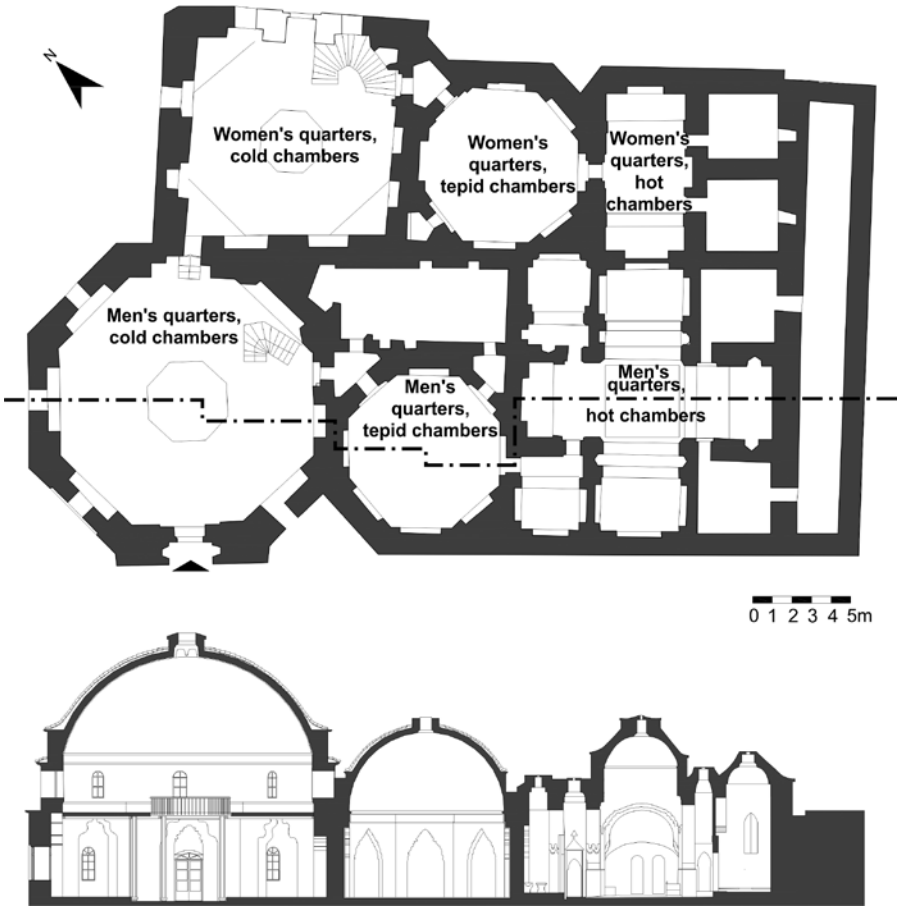


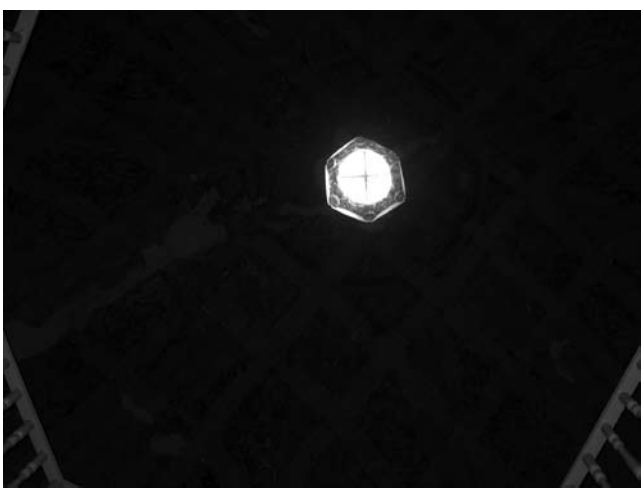
Figure 1. The ground plan of Bay Hammam (redrawing after (Kanetaki, 2004a)).

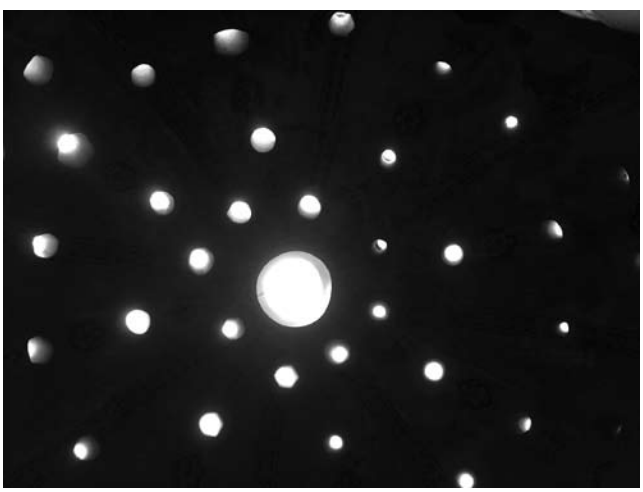
are positioned on each side of the octagonal envelope at the upper level. An oculus at the top of the vault helps towards achieving uniformity of daylight across the height of the room (**Figure 2**).

In the south-eastern side lies the tepid room, also octagonal, covered by a dome, on the upper area of which its central oculus prevails. Around the central oculus, 50 smaller circular light openings are distributed in 4 concentric circles (**Figure 3**).

Figure 2. The light openings on the dome of the cold area of Bey Hammam.

Figure 3. The light openings on the dome of the tepid area of Bey Hammam.





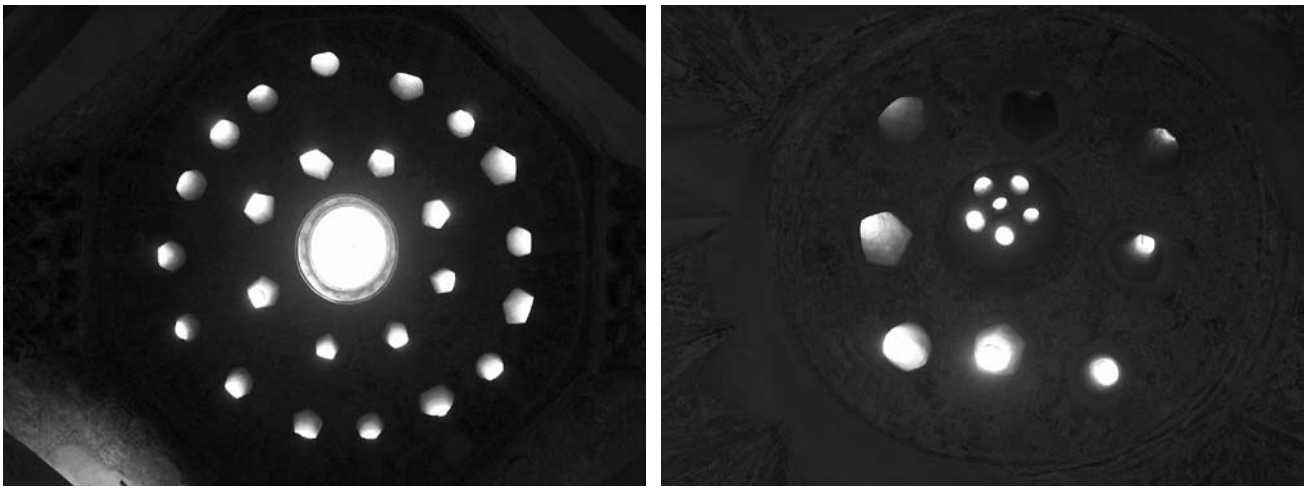


Figure 4. The configuration of light openings on the central (a) and on one of the peripheral domes (b) of the hot chambers in Bey Hammam.

Figure 5. Light openings distributed between adjacent arches supporting domes.

Further to the east lies the complex of hot chambers, ordered around a large cruciform room, where the massage table stands in its centre. Eight smaller areas open on this space, each of which is covered by a separate dome. Light openings are located on each dome, as well as between adjacent arches supporting the domes. It is characteristic that only the central dome of the hot area, which is directly above the massage table, is equipped with an oculus; 24 circular light openings distributed in 2 concentric circles provide daylight to the heart of the hot chambers (**Figure 4a**). On the contrary, in the remaining eight areas comprising the hot chambers, the central oculus is replaced by a complex of smaller oculi located close together on the upper part of their domes. Daylight is strengthened by additional round openings distributed symmetrically on the hemispherical surfaces (**Figure 4b**). It is worth mentioning that several light openings are positioned between adjacent arches that support the domes (**Figure 5**). In total, 150 round light openings exist on the domes of the hot chambers.

In **Table 1**, the area of lighting openings (both lateral and horizontal) of each chamber is associated with the floor area that they serve. It is interesting to note that the ratio of the window to floor area is almost 3.5 times higher for the cold room, when compared to the respective value found in tepid and hot chambers. On the contrary, the transparent to opaque ratio differs slightly between the tepid and the hot chambers.

Daylight levels and distribution were recorded during March 2008 under different sky conditions, i.e. overcast and clear, in selected points of the three chambers of the building. More specifically, in the cold room, 35 measurement points were chosen on three imaginary concentric octagons, dictated by the geometry of the building. The points were numbered and the distance between them was measured carefully. With the help of a

Table 1. Interrelation of window and floor area for cold, tepid and hot chambers of Bey Hammam.

	Floor area [m^2]	Window area [m^2]		Window to floor area [%]
		Lateral openings	Roof openings	
Cold chambers	137.62	6.016+5.612	0.636	8.911
Tepid chambers	43.54	-	1.081	2.483
Hot chambers	129.89	-	2.851	2.195

portable lux-meter, the daylight illumination prevailing on each point was recorded.

The same procedure was followed in the tepid room. In that case, 25 measurement points were selected on two concentric octagons, following not only the geometry of the space, but also the distribution of light openings on the dome.

Finally, in the hot chambers, the measurement points formed a theoretical dense grid, which included characteristic points, such as at the centre and around the massage stone, at the edges of the marble basins (3 basins per room) and on the steps that separate the central area from the individual rooms.

The results of the measurements are presented graphically on the plan drawings of the building; illumination levels are plotted on a grey scale, ranging from 0 lx to 120 lx at a step of 10 lx.

THE ILLUMINATION PREVAILING IN THE INTERIOR OF BEY HAMAM

The daylight levels prevailing in the interior of the monument under cloudy sky conditions are schematically presented in **Figure 6**. In general, illumination ranges in low levels; from the colour variation, it becomes clear that the lowest levels of illumination are recorded in the cold chambers, while higher levels prevail on the central area of the hot area.

In the cold room, high levels of illumination occur at the areas in front of the lateral openings. However, a window located on the eastern side of the doorway entrance is covered by an opaque element, hindering the admittance of solar radiation. Moreover, for the same reason, the lateral openings of the upper storey do not contribute to the formation of indoor daylight conditions. The oculus on the top of the dome fails to contribute to the uniform distribution of daylight on the lower level, due to the significant height of the room, the low reflectance of the surrounding surfaces and the existence of the balcony.

In the tepid room, daylight is distributed uniformly. Central areas are better lit, since more openings are arranged near the centre of the dome. Moreover, the openings on the top of the dome exploit the luminance of the

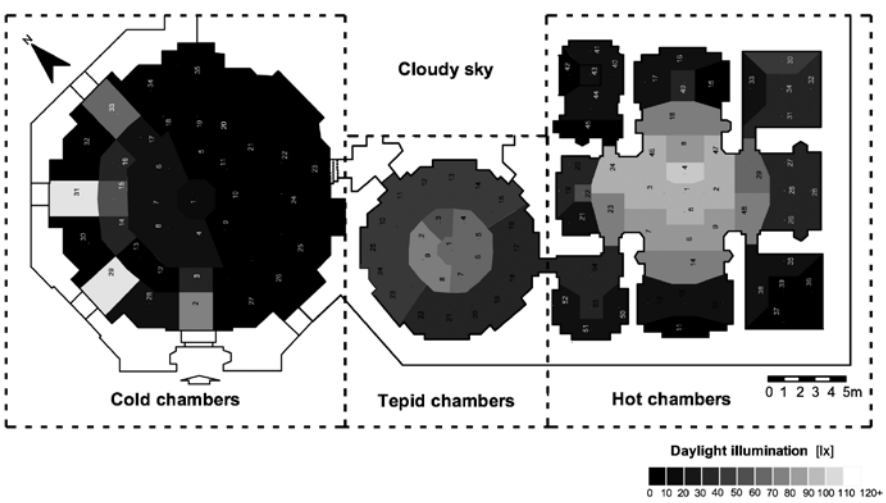


Figure 6. The illumination levels prevailing on the interior of the cold, tepid and hot chambers of Bay Hammam under overcast sky conditions.

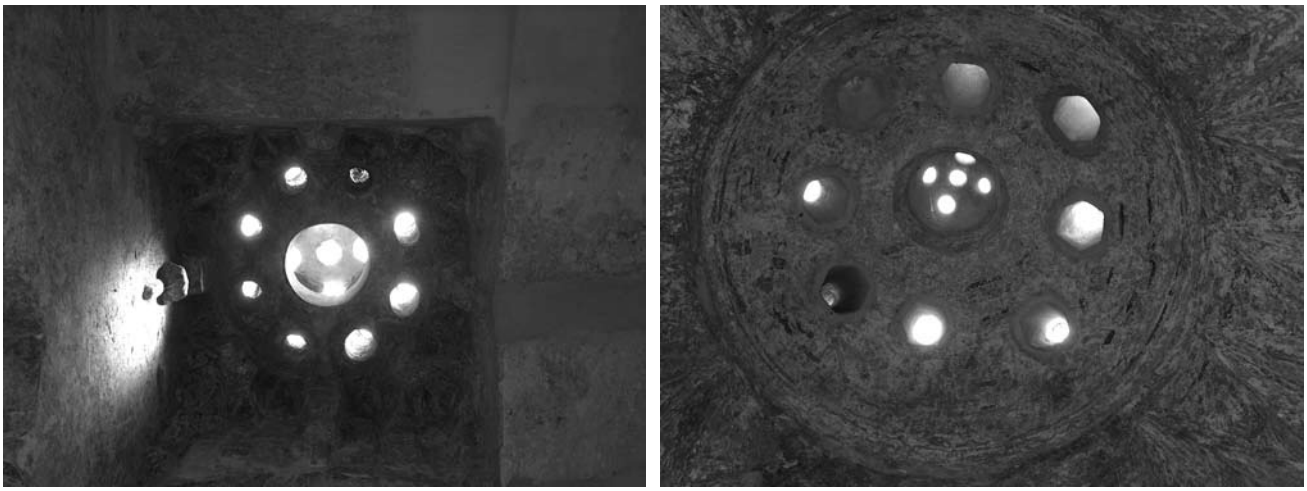


Figure 7. Different window configurations for maintaining low illumination levels in certain part of the hot chambers in Bay Hammam.

upper sky vault segments, which increases towards zenith under overcast sky conditions.

In the hot chambers, daylight levels are increased in the centre of the room and become gradually lower towards the lateral masonries of the 8 compartments. The oculus and the surrounding light openings on the central dome, which actually cover one third of the total opening area of the hot chambers, provide plenty of daylight on the massage table, where the ritual of cleanliness takes place. The eight compartments appear to be darker, not only because of the lower area of transparent elements, but also due to the different formation of both openings and the structural basis of the dome.

More specifically, it is characteristic that the upper openings on the peripheral domes of the hot chambers are elevated in relation to the hemispherical dome. Although a set of smaller openings replace the oculus, the light entering the dome is further filtered by a round element representing the oculus (**Figure 7a**). Moreover, it seems that the specific domes are constructed with a higher thickness (**Figure 7b**); the light openings around the zenith axis are tilted towards the imaginary centre of the dome, leading to reduced daylight levels: they collect less daylight, since they can "see" parts of the sky vault of lower luminance and additionally, the admitted daylight is being consecutively reflected and absorbed by the opaque elements. Towards that direction serves also the configuration of the peripheral compartments of the hot chambers, since their low floor area with regard to their significant height leads to a tubular form, on the vertical sides of which daylight is reflected and gradually becomes attenuated.

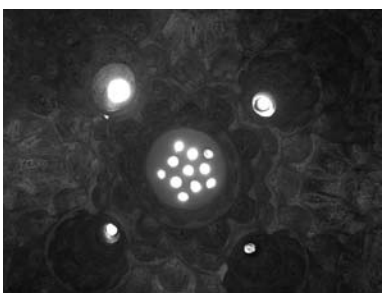


Figure 8. The windows of the sultan's compartments, located on the upper left side of the hot chambers.

The attenuation of daylight via gradual diffusion is achieved in a more sophisticated way in the private part of the sultan's compartments (at the northern part of the hot chambers) with the help of decorative elements on the internal surface of the dome (**Figure 8**). Such configuration leads also to the reduction of glare formation, since the areas directly surrounding the areas become brighter and the contrast between transparent and opaque elements is lower.

It is worth mentioning that during clear sky conditions, similar results have been derived for the hot area. More specifically, in **Figure 9** daylight levels prevailing on the reference plane of the male quarters of Bey Hamam have

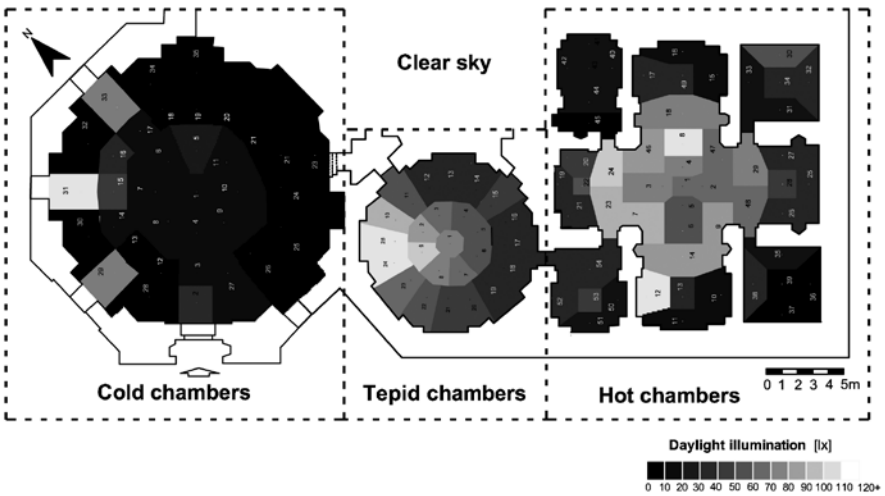


Figure 9. The illumination levels prevailing on the interior of the cold, tepid and hot chambers of Bay Hammam under clear sky conditions.

been plotted. It is noteworthy that the centre of the hot chambers is bright, while the surrounding areas remain much darker. In the warm area, the uniformity of daylight differentiates with respect to the cloudy conditions, since direct daylight is admitted through the light openings on the south-eastern part of the dome at the time of the measurements. Daylight is then reflected on the vertical and horizontal elements of the area, leading to the increase of daylight levels not only in the specific area receiving direct illumination, but also in the entire room.

CONCLUSIONS AND DISCUSSION

From the analysis of the illumination levels prevailing in the examined monument, it is inferred that the daylight levels differ significantly among the spaces constituting the *hamam*, which indicates that there is a strong relation between daylighting and each individual usage, especially regarding the activities taking place in the tepid and the hot chambers.

The role of the tepid room is to prepare the bather both physically and mentally for the ritual of bathing in the hot chambers; a pleasant area, with medium illumination distributed uniformly on the reference plane would help towards the relaxation of the users. In the hot chambers, special attention is given to the central area, where the marble slab stands. Taken into account the symbolic aspects of light and bathing in the Islamic culture, the high daylight levels prevailing on that part of the chambers could be associated with the presence of God, who is apparent as light from above to those taking part in the corporal cleanliness procedure. The transition to the darker areas leads to the completion of the ritual procedure; the bather feels relaxed, calm and satisfied with fulfilling his religious duty.

Based on the above, it can be derived that daylight has served once again as the medium for creating sophisticated impressions and strengthening the religious spirit by combining the corporal cleanliness achieved through the ritual bathing in *hamams* with the presence of God presented as light.

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TARİHİ HAMAMLARDA GÜNIŞIĞI İLE AYDINLATMA: OSMANLI HAMAMLARI

Bu makale, tipik bir 15. yüzyıl Osmanlı Hamamı olan Selanik Bey Hamamı özelinde gerçekleştirilmiş olan, hamamlarda aydınlanma çalışmasını aktarmak üzere oluşturulmuştur. Çalışmanın amacı, hamam mekanlarının kullanımına bağlı değişen günışığı düzeylerini ve bunların tinsel değerlerinin etki ve etkileşimini araştırmaktır. Bu amaçla, hamamın farklı odalarındaki aydınlanma düzeylerini ve ışığın dağılımını belgelemek üzere izleme ve ölçüm gerçekleştirilmiştir. Sonuçları yorumlamak ve ilişkilendirebilmek adına, yıkanma kültürünün gelişen felsefesi ve Osmanlı hamamlarındaki simgesel yaklaşımlar incelenmiş ve belirtilmiştir. Sonuç olarak, farklı ışık açıklıklarından kazanılan gün ışığının, bir kez daha,

sofistike etkileri yaratan, güçlendiren ve uhrevi ışık sıfatıyla, dini etkilerle fiziki temizliğin birleştiği Osmanlı Hamam ritüelini ortaya çıkarma etkili bir tasarım aracı olduğu kanıtlanmıştır.

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